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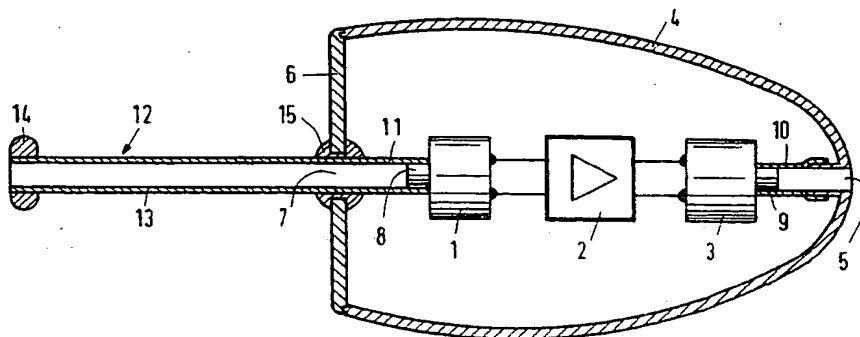
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NL-5656 AA Eindhoven(NL)**(54) **Hearing aid intended for being mounted within the ear canal.**

(57) An in-the-ear canal hearing aid comprises a microphone (1), an amplifier (2) and an electromechanical transducer (3), for example in the form of a telephone. The hearing aid further includes an extraction means (12) for extracting the hearing aid from the ear canal. The extraction means (13) is in the form of a hollow tube whose one end is me-

chanically attached to the housing (4,6) of the hearing aid at such a position that the channel in the tube is acoustically coupled to the sound entrance (7) of the hearing aid. As a result, the extraction means (12) has as its second function the suppression of acoustic feedback.

**FIG.1**

The invention relates to a hearing aid intended for being mounted within an ear canal, comprising a microphone, an amplifier and an electromechanical transducer, for example, a telephone, accommodated in a housing, and including an extraction means for extracting the hearing aid from the ear canal, the input to the microphone being acoustically coupled to a sound entrance in the housing.

Such a hearing aid is known from United States Patent 4,756,312. A contact hearing aid is discussed there, in which the electromechanical transducer is in the form of a piezoelectric element generating vibrations which are transferred directly to the tympanic membrane. For this purpose, the hearing aid is to be mounted deep within the ear canal. It is more customary for the transducer to have the form of a telephone (loudspeaker) with which acoustic signals are generated which hit the tympanic membrane. In this embodiment too there are hearing aids which are to be mounted deep within the ear canal. For extracting such hearing aids from the ear canal, the hearing aids comprise extraction means.

The extraction means in the prior art hearing aid is in the form of a rod of ferromagnetic material which at one end cooperates with a magnet and at the other end is capable of cooperating with a magnetic ring attached to the housing of the hearing aid. The magnet may be disposed in two positions relative to the rod. In one position of the magnet the hearing aid may be extracted from the ear canal by means of the magnetic force exerted on the ring of the hearing aid by the other end of the rod. In the other position of the magnet the rod can, prior to the hearing aid being extracted, be inserted into the ear canal without a force being exerted on the hearing aid by the rod. The prior art hearing aid thus has the drawback of requiring a separate accessory for extracting the hearing aid. It is known to use, *in lieu of* a separate accessory, a component which is mechanically, hinging or not, coupled to the housing.

It is an object of the invention to propose a different type of extraction means so that a separate accessory is not required either.

The hearing aid according to the invention is thereto characterized, in that the extraction means is in the form of a hollow tube whose one end at the sound entrance is mechanically coupled to the housing, so that the sound entrance is acoustically coupled to the channel in the acoustic tube.

The measure according to the invention is based on the recognition that with respect to the extraction means a choice is to be made so that also further problems that may occur with a hearing aid can be remedied simultaneously. The fact is that a further problem often occurring with hearing aids is the acoustic feedback. In that case there is

a too strong sound transfer from the telephone to the input of the microphone, which causes acoustic feedback. According to the invention the extraction means in the form of a tube is furthermore used as an acoustic guide of external sound to the microphone input. The acoustic feedback path is thereby extended by roughly twice the length of the tube, which means that a further suppression of undesired oscillations can be realized. The acoustic tube thus has a twofold object. On the one hand the tube serves as an extraction mechanism and on the other hand the tube serves as a means for further suppressing acoustic feedback.

There is an additional advantage if the tube is made of a flexible material. In that case the acoustic feedback, which especially occurs if a switched-on hearing aid is extracted, may be avoided by pinching the tube while the hearing aid is being inserted or extracted.

The invention will be further explained in the following description of the Figures with reference to an exemplary embodiment, in which:

Figure 1 shows a first exemplary embodiment and

Figure 2 shows a second exemplary embodiment.

Figure 1 shows in a diagram a hearing aid which can be mounted within the ear canal, a so-called in-the-ear canal hearing aid. The hearing aid comprises a microphone 1, an amplifier 2 and an electromechanical transducer 3 which are all accommodated in a housing 4. The housing 4 has an external shape adapted to the internal shape of the ear canal of the user of the hearing aid. The transducer 3 is a telephone (loudspeaker) in the present example. The hearing aid is inserted into the ear canal in such a way that the sound exit 5 of the hearing aid is directed towards the tympanic membrane. The sound output 9 of the telephone 3 is acoustically coupled to the sound exit 5 by way of a tube 10. The housing 4 is shut off by a cover 6 on the side remote from the tympanic membrane. In this cover there is a sound entrance 7 which is acoustically coupled to the sound input 8 of the microphone 1 by means of an acoustic tube 11. The cover 6 may comprise still more components of the hearing aid, such as a volume control, and it may have an opening for inserting a battery which opening may be closed by a button (not shown).

The hearing aid further includes an extraction means 12. The extraction means 12 is in the form of a hollow tube 13. One end of the tube 13 is acoustically coupled to the sound entrance 7 in the cover 6. With this one end the tube 13 is furthermore mechanically attached to the cover 6 by means of a grommel 15. The other end of the tube 13 has a thickening 14.

The tube 13 has such a length that the user

can pull the hearing aid out by the thickening if the hearing aid is embedded in the ear canal. The tube 13 furthermore serves as an acoustic tube through which the external sound signals can be fed to the sound entrance 7 and thus to the microphone 1. 5  
The tube 13 extends the acoustic transfer path from the telephone 3 to the input 8 of the microphone 1, so that there is less chance of acoustic feedback. The tube 13 thus not only serves as an extraction means but also as a means for suppressing acoustic feedback. 10

The tube 13 may be made of a rigid or a flexible material. In the latter case one may think of, for example, a piece of silicon hose.

In the exemplary embodiment shown in Figure 1 the tubes 11 and 13 are arranged as a single tube. Figure 2 shows a somewhat different embodiment in which the tube 13 and the tube 11 do not form one whole but are each connected with the cover 6. 15  
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#### Claims

1. Hearing aid intended for being mounted within an ear canal, comprising a microphone, an amplifier and an electromechanical transducer, for example, a telephone, accommodated in a housing, and including an extraction means for extracting the hearing aid from the ear canal, the input to the microphone being acoustically coupled to a sound entrance in the housing, characterized in that the extraction means is in the form of a hollow tube whose one end at the sound entrance is mechanically coupled to the housing, so that the sound entrance is acoustically coupled to the channel in the acoustic tube. 25  
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2. Hearing aid as claimed in Claim 1, characterized in that the tube is made of a flexible material. 40
3. Hearing aid as claimed in Claim 1 or 2, characterized in that the other end of the acoustic tube comprises a gripping means. 45

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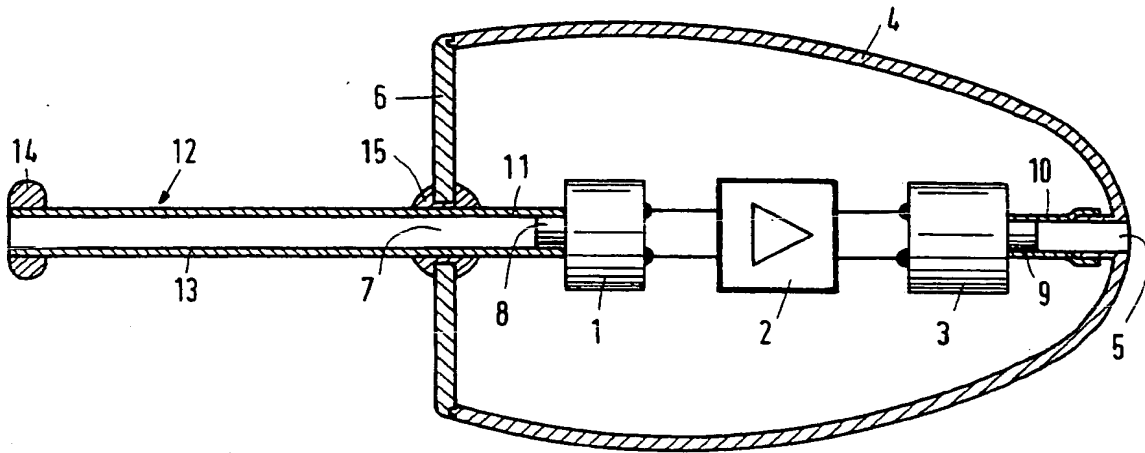


FIG.1

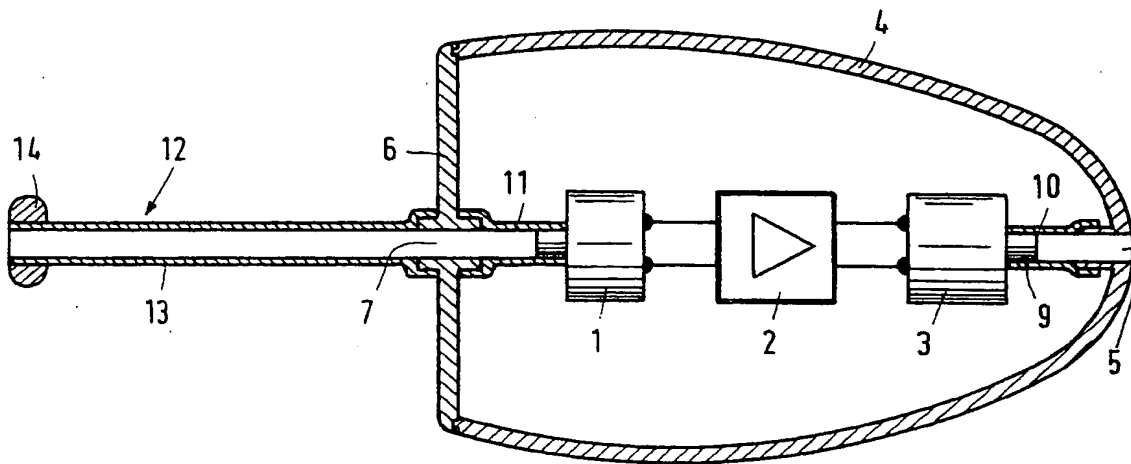


FIG.2

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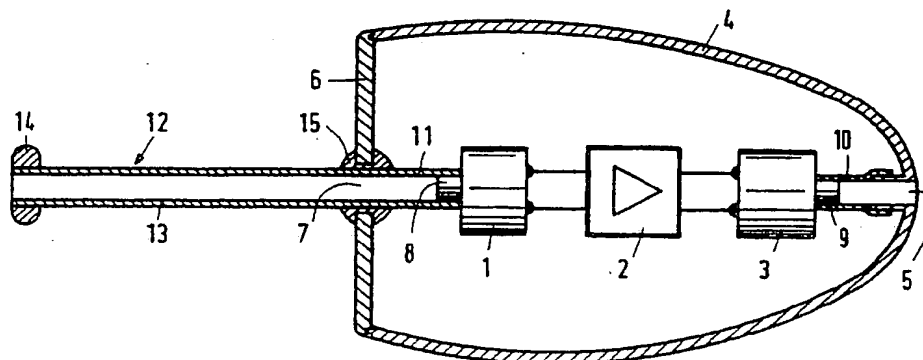
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chanically attached to the housing (4,6) of the hearing aid at such a position that the channel in the tube is acoustically coupled to the sound entrance (7) of the hearing aid. As a result, the extraction means (12) has as its second function the suppression of acoustic feedback.

**FIG. 1**



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## EUROPEAN SEARCH REPORT

Application Number

EP 92 20 1575

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	WO-A-9 104 644 (RESOUND) * page 1, line 6-10 * * page 5, line 19 - line 32 * * page 7, line 3 - page 8, line 17 * ---	1-3	H04R25/02
A	EP-A-0 368 125 (HÖRGERÄTE GEERS) * column 1, line 1-5 * * column 2, line 18 - line 52 * ---	1-3	
A	US-A-4 869 339 (BARTON) * column 2, line 33 - column 3, line 59 * ---	1-3	
D,A	US-A-4 628 907 (EPLEY) * column 3, line 35 - line 51 * * column 3, line 67 - column 4, line 5 * * column 6, line 53 - column 7, line 42 * -----	1,3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H04R
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 APRIL 1993	Examiner ZANTI P.V.L.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background U : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document			

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